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FRONT COVER: *Battersea Park Pleasure Gardens, by G. Glaser*

OUR CONTRIBUTORS

Richard Beeching, *B.Sc., Ph.D., D.I.C., A.R.C.S., F. Inst. Physics, A.M.I. Metallurgists, C.I. Mech. E., was appointed I.C.I. Technical Director on 24th January 1957, succeeding Sir Ewart Smith. His career in I.C.I. has been one of rapid promotion and change. 1st March 1948, joined Head Office Technical Department and worked at Nobel House. 1st April 1951, transferred to 'Terylene' Council as a full member of Council, and from April 1953 until December 1954 seconded to Canada. 1st February 1955, appointed chairman of Metals Division and moved to Birmingham. He is 44 years old.*

John Watney, *author of the best seller "The Enemy Within" and a member of Central Publicity Department, contributes the third of his schoolboy reminiscences in which fact and fiction are mixed. The previous two in this trilogy, entitled "Escape" and "The Smoke in Hiawatha," were published in April 1956 and March 1957. John Watney's next book, "Beginners Luck," will be out in the autumn.*

Twenty-five Years of 'Perspex'

By a special correspondent

'Perspex,' a household word today, is one of I.C.I.'s major industrial inventions, ranking perhaps next after polythene. Like polythene, too, it made a significant contribution to our war effort. Here is the inside story of the discovery and development of this remarkable world-wide plastic.

LAST August 'Perspex' celebrated its twenty-fifth birthday. Today 'Perspex' or, to give it its rather long-winded chemical title, polymethyl methacrylate sheet, is one of Plastics Division's biggest money spinners. Production last year topped 11,000 tons, and already plans are afoot for new plant at Darwen in Lancashire and at Billingham—a far cry from the first plant at Billingham, built to make 110 tons a year.

The story of 'Perspex' actually begins in August 1932, when a young Nobel Division research chemist filed his patent for making methyl methacrylate monomer. The man was Dr. John Crawford, now assistant research manager of Plastics Division. The process he patented, known as the acetone cyanohydrin process, took methacrylic resins right out of the category of laboratory curiosity and opened up the way to cheap commercial manufacture.

The idea of making these resins was not originally an I.C.I. one. The polymerising properties of methacrylic esters had in fact been reported on as long ago as the 1880s by German chemists. I.C.I. picked up the subject almost accidentally in 1930 through a Canadian chemist, Dr. William Chalmers of McGill University, who was interested in the possible use of these esters as the "sandwich" layer for safety glass. Nobel Division too, as the manufacturers of nitrocellulose for celluloid which at that time was used as the filling material for safety glass, were interested.

At considerable cost a small quantity of methyl methacrylate monomer was made and then polymerised in the laboratory at Stevenston. From the safety glass angle tests were disappointing, but it soon became obvious that here was an important new plastic in its own right if only an economic method of manufacture could be discovered. Dr. Crawford set to work on the problem and produced the acetone cyanohydrin process for making methyl methacrylate monomer. This is the method used at Wilton today and indeed all over the world.

Cheap monomer was the first hurdle passed. But it was another three years before the first sheet of 'Perspex' was produced for sale. During that period Dr. H. J. Tattersall of Nobel Division and later (when responsibility for "Resin M," as the polymer was then called, passed to Billingham Division) Mr. P. H. Hull worked away at the problem of casting sheets of the resin from the monomer. By the autumn of 1935 work had progressed sufficiently to make possible the starting up of the first commercial plant.

To look back on now, this tiny plant was an extraordinary affair. Set up at Billingham on the site where the present 'Diakon' plant now stands, it was simply a small room which was kept at a temperature of 40° Centigrade—the temperature at which the monomer could be polymerised and hardened into the transparent sheet as we know 'Perspex' today. Not surprisingly, it became known as the "Forty Chamber."

Briefly, the method used was this. The methyl methacrylate monomer—a colourless liquid looking like water but with a very penetrating smell—and a catalyst were poured into 5-litre (roughly a gallon) glass flasks which were suspended in an ordinary household bath full of water. This was then heated. After several hours the liquid began slowly to thicken and was then ready for casting into sheets.

The thickened monomer syrup was poured into a box with a plate glass bottom; a second sheet of glass was lowered on to the surface of the syrup and counterpoised in this position by springs attached by suckers to the top of the plate. This cell was then left in the room for several days (even a week or so if thick sheet was wanted), by which time the high temperature had completed the polymerisation process and the resulting solidified transparent polymer sheet could be stripped away from the sheets of glass.

Sweat and Tears

Most new processes go through a "sweat and tears" stage, and 'Perspex' was no exception—in more senses than one. The eight processmen on the pilot plant had to work stripped to the waist owing to the hot, damp atmosphere. The process was extremely crude, and the men had to be continually on the lookout for trouble. If the monomer was overheated during syrup preparation the whole batch was ruined, for the resulting sheet would be bubbly and opaque. Occasionally the whole batch blew up—the origin of the white stalactites which accumulated on the roof. Most important of all, it was very difficult to produce sheets of even thickness all over, for as the polymer hardens it shrinks as much as 20%, so frequent spirit level tests had to be carried out.

Early Hopes

For 'Perspex,' as for other plastics, many fanciful applications have been suggested at various times. One of the earliest, and the craziest, was the use of 'Perspex' for armour.

It was noticed at Ardeer that when bullets were fired at 'Perspex' the sheet did not break and that, indeed, the bullet made only a tiny mark. Those carrying out the experiment assumed that the bullet had rebounded from the sheet, and in imagination tanks and even battleships were constructed from the material. Tests at Witton soon showed, however, that the heat developed when the bullet struck the 'Perspex' was great enough to melt it, so that the bullet passed through the hole, which sealed up behind it.

'Perspex' battleships, then, were out. But no one worried overmuch, for the Junior Service had been wooed and won. From 1936 right up to the end of the last war, almost our entire production of 'Perspex' sheet went to the aircraft industry to be used for

Inspection of 'Perspex' sheets. *These sheets can be anything from 1 mm. to 4 in. thick and in any one of a hundred colours. After inspection each sheet is coated with paper to protect the surface.*

domes, gun turrets and "blisters," instrument panels and so on.

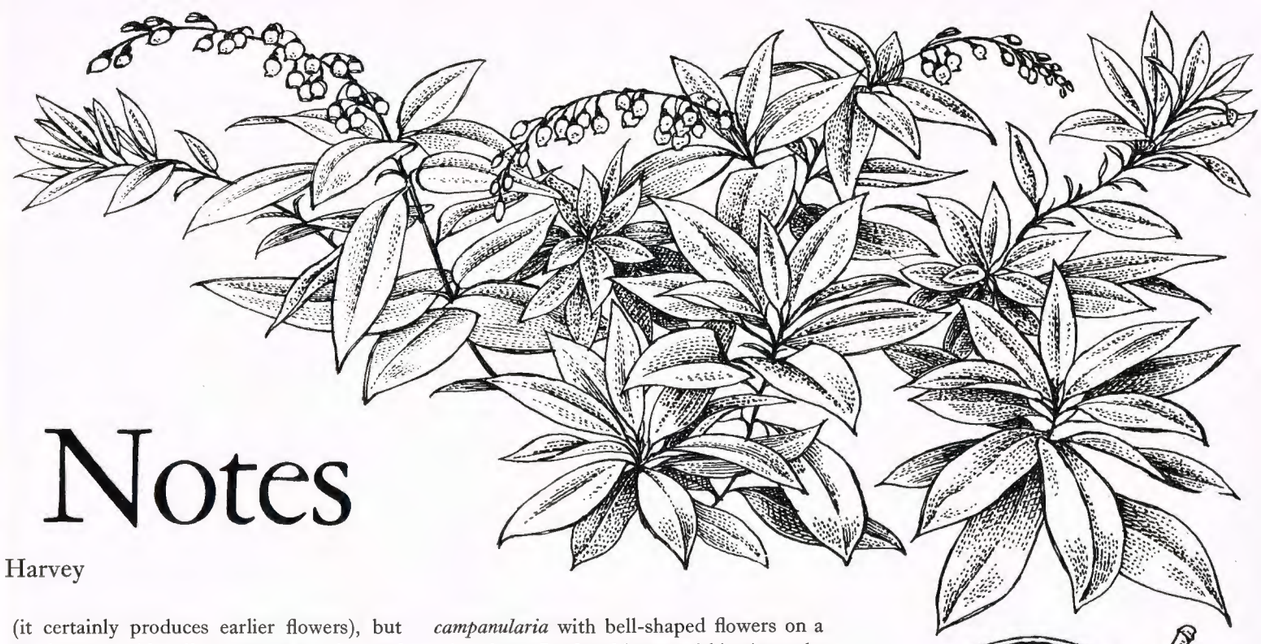
At first, however, 'Perspex' was not the only material used for cockpit covers. News from the Middle East at the height of the Libyan campaign that a large number of aircraft had had to be grounded because the sunlight had turned the cockpit covers a cloudy yellowish colour caused at one time considerable anxiety in Whitehall, where they began by blaming 'Perspex.' But they were barking up the wrong tree. The faulty cockpits were found not to be I.C.I. material; and from that moment it was 'Perspex' only for all planes.

By 1937 the Billingham plant had a capacity of just over 100 tons. Gradually process difficulties were ironed out and extensions built, so that by the time war broke out annual production had risen to 350 tons. Also in 1939 a milestone in 'Perspex' manufacture was reached with the development of a new cell for casting 'Perspex' in which the sheets of glass were sealed together with a flexible rubber gasket instead of the old cumbersome wooden frame. The cells were heated in ovens instead of the open shop. This meant a far closer control on the thickness of the sheet.

By 1941 the arms race pushed production up to 1500 tons. This was made possible by the opening of two shadow factories in Lancashire—one at Darwen in a disused cotton mill and the other at Rawtenstall in an old bleach works. The new factories were almost entirely manned by women. Conditions were hard—there was no mechanisation in those days, and the heavy glass cells used to make the polymer sheet had to be hand loaded into the ovens. Production eventually

(Continued on page 31)

'Perspex' sandwiches *just after removal from the ovens, where the layer of syrup between the glass is heated until hardening is completed. After leaving the ovens, jets of water are sprayed on the sandwiches to cool them off and ease the job of stripping the glass from the 'Perspex' sheet.*



Garden Notes

By Philip Harvey

MANY gardeners are terribly conservative over their choice of seed potatoes. Textbooks often recommend one to grow varieties known to crop well in the immediate neighbourhood—excellent advice so far as it goes—but any amateur worth his salt knows that trying new varieties (whether potatoes or other vegetables, fruits and flowers) is half the fun of gardening. Because your grandfather grew bumper crops of King Edward VII and Majestic on his allotment only ten minutes' walk away it does not follow that you should ignore present-day varieties. Nor is it necessary to concentrate on varieties grown for market. The farmer must confine himself to potatoes which are regular and heavy croppers. The gardener can afford to plant for quality rather than quantity. Sometimes he can attain both objectives, but cake and jam must not be expected every time in gardening. Roses are a good parallel. If a variety is satisfactory but lacks fragrance, do you refuse to plant it in your own garden?

A typical instance of quality as opposed to quantity is the incomparable maincrop potato Golden Wonder. Here is a variety which is an uneven light cropper, demanding light, warm land liberally enriched with farmyard manure or compost if it is to do really well. The tubers are russet-brown with a floury chestnut flavour—better I think than any other variety. Golden Wonder is probably at its best after Christmas and is an excellent keeper. There are several varieties which are not far behind for quality and are generally heavier croppers—Redskin is one, the only weakness being the pinky-red colour of the tubers, which are often difficult to detect when lifting. It is usually fairly resistant to potato blight. Arran Victory and Ulster Premier are also notable for flavour.

It is always best to sprout the tubers a month or so before planting, as earlier and heavier yields are obtained. The most suitable tubers for planting are usually those weighing about 2 oz. and the size of a hen's egg. Place in shallow boxes or trays, the end with the greatest number of eyes being uppermost. A light, frostproof shed or other building where temperature averages 40–45° F. is ideal. Higher temperatures lead to long, weakly sprouts.

How many sprouts should be left on each tuber when planting time comes round? Obviously there is no cast iron answer, because one can leave all the sprouts, even if the result is an abundance of small potatoes. My own view is that three sprouts should be left, which ensures a high percentage of decent-size tubers. Small potatoes are a nuisance to peel and cook. If you retort that they can easily be cooked in their jackets, my reply is that potatoes boiled in this way are only fit for those misguided persons who regard their intake of vitamins as more important than the enjoyment of good food for its own sake.

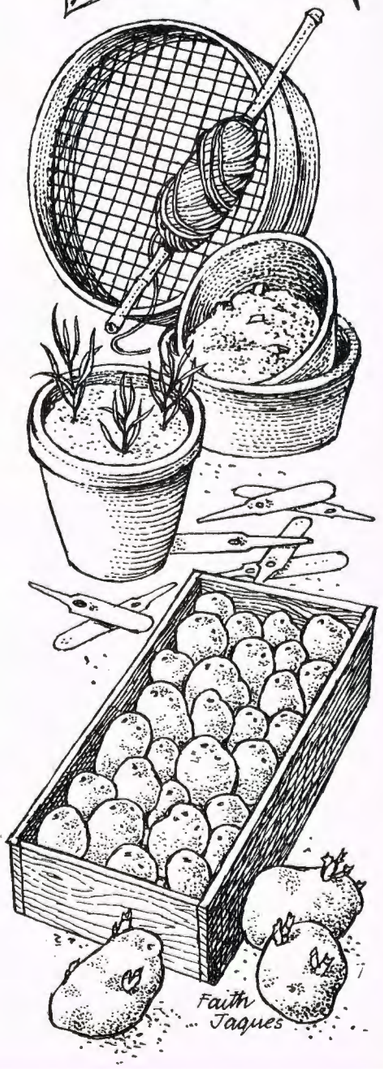
Catalogues are always reminding us that most hardy annuals can be sown outdoors in August and September as well as in spring. Admittedly this may ensure sturdier plants (it certainly produces earlier flowers), but on heavy, cold soils, autumn sowings of hardy annuals (as with round-seeded peas and broad beans) are a gamble, especially where space is limited. It is, I think, advisable to sow from March to early May in their flowering positions. Thin sowings are important, also early thinning out to allow each plant sufficient space to give the maximum display of which it is capable. Godetias provide an excellent example of plants which, though very showy when massed in a bed or border, will stand up to the closest examination, as the individual flowers are extremely beautiful. If crowded together they are unable to branch freely and there are fewer blooms. The tall varieties ought to be thinned to at least 8 in. apart, the dwarf kinds like Celestial, Kelvedon Glory and Sybil Sherwood to about 6 in. Godetias are favourite bee plants and can be strongly recommended for cutting, as the blooms are long lasting. The brightest colour in Godetias is probably the new cherry-red variety Vivid, which grows to 15 in.

Here are three out-of-the-way flowers for sowing this spring.

Mentzelia lindleyi is the correct name for the hardy annual often catalogued as *Bartonia aurea*, a delightful, easily grown plant which bears large golden-yellow, five-petalled fragrant flowers, two or three at the top of each stem. They open in the evening, remaining open until the next morning. The height is about 15 in. Another neglected annual is the rich blue *Phacelia campanularia* with bell-shaped flowers on a 9 in. plant. It often blooms within six weeks of sowing.

Ionopsidium acaule, popularly known as Violet Cress, seems to like my heavy, sticky soil, as it reproduces itself by self-sown seedlings which survive the wettest of winters. The white and violet flowers (which really merit that overworked adjective "dainty") are profusely borne on a plant only a couple of inches high and are most effective at the front of a herbaceous border. One otherwise honest catalogue claims that they "emit a sweet honey-like fragrance." To my tobacco-deadened senses there is no scent whatever!

Many half-hardy annuals can be sown outdoors in late May or early June. Zinnias are a typical instance, although north of the Trent it would be best to sow under cloches to obviate the shorter growing season. While these plants dislike dryness at the roots during the summer they are unhappy in cold, very wet spells. Light, rich, perfectly drained soil and a really sunny position are essentials. Astonishing advances have been made in these plants during the last ten years by Californian hybridists. The new giant chrysanthemum-flowered type, which has been exhibited on several occasions at the Southport Flower Show, has huge blooms 5–6 in. across with curled and twisted petals and in a wide colour range. Despite their size these zinnias are in no way coarse, indeed they have a distinctly lighter appearance than the older types. They are first-class for cutting.



Central Council at Blackpool

Illustrations by Sallon

Once again the Company was asked at Central Council to put their hands deeper in their pockets: a silver watch after 15 years' service instead of 20 years as now, automatic Staff Grade promotion, and a quicker distribution of the profit-sharing bonus were among the suggestions put forward.

FOR only the second time since he became Chairman in 1953 Sir Alexander Fleck was unable to be present at a Central Council meeting. He was in London receiving an honorary degree of London University at the hand of the Queen Mother.

Mr. S. P. Chambers, a deputy chairman of I.C.I., took the chair in Sir Alexander's absence, and commented on the Company's results for the first half of the year. Sales rose from £214 million to £235 million and net profits after taxation from £11 million to nearly £16 million. This increase, Mr. Chambers stated, was due largely to the increasing sales of such products as 'Terylene' and titanium, on which many millions of capital had been spent in recent years. He expressed "the cautious hope" that the second half of the year was going to be as good as the first half.

Mr. Chambers went on to stress the relationship between capital and savings. "Capital expenditure," he said, "is needed both in the public sector—hospitals, schools, roads, railways—and in the private sector of industry—factories, plant, machinery—to enable our productive efforts to match those of our competitors overseas. Capital can only come out of savings, and, although we are saving more than we were six to ten years ago, it is still not enough; our savings are far less per head than those in the United States, Russia and Germany. If we lose the battle for savings, we lose the battle against inflation and the battle against our foreign competitors. All this would mean lower living standards or large-scale unemployment, or both."

J. Smith (Dyestuffs)

A pleasant item of business cropped up early on when the Chief Labour Officer, Mr. E. T. Grint, rose to his feet to tell Council that the Board had agreed to give an award to all employees achieving 50 years' service. Not that such an achievement has gone unnoticed up till now. Sir Alexander Fleck, when he became Chairman, had instituted the custom of sending a personal letter of thanks to each man or woman achieving their half-century. The new award would be complimentary to this, and unlike the standard 20, 30 and 40 year awards, each employee would be able to choose his own award. The only thing debarred was a gift of money.

W. Cumming (Nobel)

Mr. Grint gave two possible suggestions—a week's holiday entirely at the Company's expense or, for someone who has never been to London, a sightseeing tour with perhaps a visit to Head Office included.

From 50 years' to 15 years' service. Mr. Fenney of Gaskell Marsh Works sponsored a General Chemicals Division motion "that the service qualification for a silver watch be reduced from 20 to

J. C. H. McEntee (Wilton)

15 years." Many companies, including one as closely allied to us as I.C.I. (India), argued Mr. Fenney, have instituted 15-year awards. Why did I.C.I. have to lag behind? Other members of the Division were eloquent on this point, including Mr. Whitfield, who won one of the few laughs at an otherwise rather solemn meeting when he remarked that even an old lag doing 20 years in jail gets five knocked off for good behaviour.

Metals Division spokesmen, however, were strongly against the motion, and the position was complicated by two amendments. The first, submitted by Nobel Division, was that a 15-year award should be introduced for women only; while Billingham wanted the time qualification reduced to 15 years at least for their external factories started up during the last war. Neither amendment met with much support, but voting for the main issue was closest on record—the motion was carried by 100 votes to 99.

Automatic promotion under the Staff Grade Scheme, an old friend, was again raised by Metals Division. They asked that every employee after a service qualification period should be promoted automatically to Staff Grade without, however, prejudicing the right of management to take a man off Staff Grade if not up to standard. Although eloquently supported by Mr. Buchanan on behalf of the 1700 workers at Grangemouth, the motion was again lost by a large majority.

A second Staff Grade motion—the reduction of the service qualification from 3 years to 18 months—had an easier passage.

Speakers were evenly divided for and against. A cautious note was sounded by Mr. J. D. Maughan (Winnington Works Manager), who quoted sickness rates for some 700 Winnington employees before and after promotion to Staff Grade: the rate more than doubled after promotion. Mr. Grint corroborated this statement and said that the same trend could be found taking the Company as a whole. The I.C.I. sickness rate for the first half of this year was half as much again as for similar sectors of the chemical industry outside I.C.I.

"The Board has never quibbled about or indeed questioned the cost of the [Staff Grade] scheme," said Mr. Grint; "but, let's face it, the figures are somewhat disturbing."

After lunch, Mr. Grint dealt with the Wilton motion at last Central Council asking for a report from the Company on the possibility of payroll workers being paid through a bank. Treasurer's Department and Legal Department had been consulted, he said, and an outside opinion from an eminent Q.C. had been obtained about the legality of this proposal under the Truck Acts. "Legally," Mr. Grint summed up, "it is practicable; administratively, it can be operated." The subject was referred back to Wilton Site Council with a request for a report to Council on any pilot scheme set up.

Mr. Banks then rose to give Council the latest facts and figures on profit-sharing. He was mainly concerned with dispelling anxiety over the number of employees selling their stock. Of shares handed over in 1955 and 1956, 41% were still held by payroll

W. Hill (Metals)

employees (the equivalent for the Company as a whole was 69%), and the rate of selling had dropped to almost nothing in the last month or so. Figures for the 1957 distribution at present stood at 74% of shares retained (staff and payroll combined, 77%), and the pattern of selling seemed to be following similar lines to last year. So much for the exaggerated newspaper reports. The total amount of stock handed out for 1956 exceeded £1½ million.

The present fall in price of our shares, Mr. Banks pointed out, although considerable, had not been as great as many similar shares and was in no way due to the sale of shares by employees.

Mr. Banks dropped a hint of possible further changes in the scheme before Council meets again; one possible subject for reform was the extra work entailed for the Stock Exchange in selling small blocks of shares. He promised Council that nothing drastic would be done adversely affecting payroll interests.

But the item concerning profit-sharing which excited most interest was the Metals Division resolution put forward by Messrs. Hill, O'Leary and Connell. This suggested an annual distribution of shares once an employee had qualified for his first £25 block. Mr. M. J. S. Clapham (Division Joint Managing Director) supported the motion, which was carried by a large majority and referred back to Divisions.

The present not too flourishing state of the Company's Suggestion Scheme was the next matter discussed. For some time the Company has been worried by the small number of really enterprising suggestions which come out of the Suggestion Scheme. In 1955–56, out of 33,000 suggestions received only 12 were felt to be worth £10 or more.

W. G. Baldry (Paints)

The meeting was thrown open to comments on the Suggestion Scheme. Recurring proposals were larger awards, closer contact between the shop floor and the men responsible for judging the ideas, and the appointment of Suggestions Officers.

The most popular motion of the whole day came late in the afternoon. This was the Plastics Division request for the training of young workers between 15 and 21 on the process as well as the engineering side. Such a scheme, it was suggested, should emphasise character development as well as vocational training in order to provide a core of experienced chemical workers who would eventually be suitable candidates for promotion to supervisory grades. The motion was carried unanimously.

Other items which ought to be mentioned were Mr. Chambers' assurance, when the Workers' Pension Fund was being discussed, that all employees affected by the merger with the Yorkshire Copper Works would receive pension rights comparable to their existing rights; a request from Nobel Division that the Company should provide facilities for the purchase of Premium Bonds similar to the existing scheme for National Savings certificates; and the presentation of the I.C.I. Safety Cup to Lime Division. A.E.B.

L. F. Wharton (Billingham)

Earth Satellites

By Dr. Richard Beeching

What makes the sputnik stay up? What speed does it fly at, and why is this high speed necessary? These and other questions were answered by the I.C.I. Technical Director in an address given to Central Council at Blackpool.

At the end of the last century the first motor cars started to appear on the roads as noisy, unreliable subjects of mirth. About ten years later, in 1905, the Wright brothers made the first controlled flight in an aeroplane. Today we can scarcely imagine a world without motor cars or a sky free of aeroplanes.

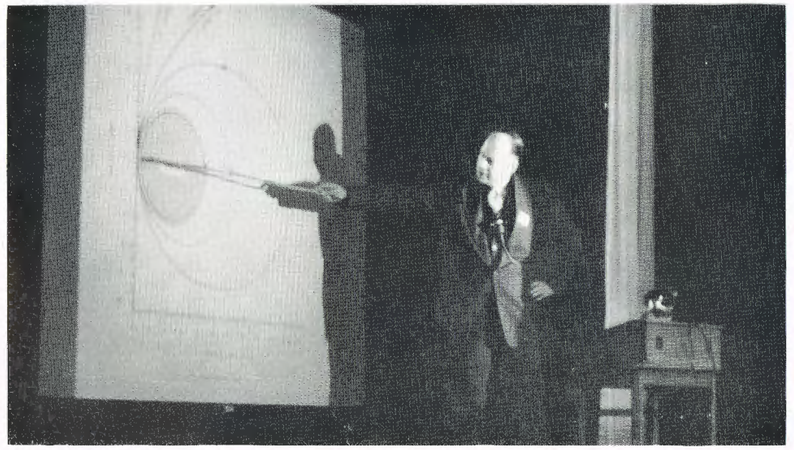
Just seven weeks ago, on 4th October, the Russians launched the first earth satellite, which has already travelled far faster and further than any other man-made object. It has already in seven weeks covered a distance of about 20 million miles at a speed of 18,000 miles an hour.

There can be little doubt that, for good or ill, the launching of objects into space will become as much a commonplace by the end of the century as aeroplanes are now. Since that is the kind of world we are going to live in, I think most of us would like to understand a bit more about this business of travel in free space than we do. I'm not an expert, so I am only going to talk to you about some of the principles, and difficulties involved, as simply as possible.

One question which many people ask is "How can the thing stay up there?" I think I can make the answer to that question a little clearer if I start by talking about something with which we are all familiar.

We all know that if you throw a stone up into the air, straight up, it goes slower and slower until it stops, and then it falls back again faster and faster until it hits the ground again nearly as fast as it left. We all know that it slows down on its way up because it is pulled downwards by the earth—by the pull of gravity—and it speeds up on its way down for the same reason.

Now, if we throw the stone up at an angle, it goes along the familiar curved path shown in the first drawing below. Its upward velocity dies away because of gravity, and it then returns again in reverse on the downward



Dr. Beeching speaking at Central Council

path. The horizontal velocity, on the other hand, is unaffected by gravity, and remains roughly the same until the stone hits the ground.

You will notice that the path is not quite the same shape on the downward side as on the upward side. That is because air resistance slows the stone down a little and makes it fall more steeply. If there were no air resistance, the path would be the same shape both up and down, and if there were no air resistance and no gravitational pull, to our surprise and dismay the stone would go off in a straight line and never stop.

Now, suppose we throw our stone, or shoot a shell, horizontally from the top of a cliff, as in my second drawing. It will hit the ground some way out, and the faster it is projected the flatter its path will be, and the further out it will go before it strikes the ground. If we look at it on a different scale, so that we can see the curvature of the earth (see my third drawing), it is easy to see that, if the bullet is fired at a sufficiently high velocity, it will fall towards the earth only as fast as the earth curves away below it, and if there were no air resistance a very high velocity projectile could be made to skim round the earth only a few miles up. The velocity necessary is about 18,000 miles/hour. The fastest anti-tank gun, or anti-aircraft gun projectiles travel at about 3500 miles/hour.

Air Resistance

In fact, of course, as we all know from experience of travelling at relatively low speeds in cars and trains, air resistance is very considerable near the earth's surface, and it increases very much with increase in speed. Perhaps that is fortunate, because it does guard us from hedge-hopping Sputniks. On the other hand, in terms of space flight it is not necessary to get very far above the earth's surface before the air disappears altogether.

At the top of Everest the pressure is less than half the pressure here, and 100 miles up there is less air than there is in the best vacuum man can produce in the laboratory. Let me put it another way. The air in a large cinema, say, would weigh about 10 tons, while at a height of 100 miles an equal volume of space would contain gas weighing less than a pinhead. Higher up still the air is even rarer, and a few hundred miles up it can be ignored altogether from the point of view of resistance to motion.

Easier Said than Done

So, you see, the job of getting a satellite into an orbit round the earth boils down to this. We have to get it up to a height of at least 150 miles, give it a velocity of 18,000 miles/hour, and point it in the right direction. My fourth drawing shows how the orbit shape depends on velocity when the satellite is launched parallel to the earth's surface. It is easy to see that if the orbit is to be nearly circular, which is best for most purposes of observation, the launching speed has to be closely controlled, and so must the angle of launching.

I need hardly tell you, still less is it necessary to tell the Americans, how much easier it is to say what has to be done than to do it.

The only known method of propelling or controlling objects in space is by means of rockets, and I want to talk to you a little bit about them so that you will understand how they work and what some of the difficulties are. Again, let's start from something we all know about.

Principles of Propulsion

When you swim in the water, you push yourself along by forcing water backwards with your arms and legs. In just the same way an aeroplane drives itself along by forcing air back by means of its propeller, or, in the case of a jet engine, it forces air backwards by compressing it, heating it and ejecting it through the jet pipe, together with gas from the combustion of its fuel. Up in space, however, there is no air to force back, nor air to cause fuel to burn, so a rocket for space flight has to carry its own oxygen supply for combustion with its fuel, and also has to rely upon forcing backwards the products of combustion alone as the means of driving itself forward.

Most of you will have seen the end of a garden hose or a flexible compressed air pipe whip about when it is released with the jet on. It is just the same effect which makes a rocket move when the hot gases stream out from the nozzle.

You know the type of rocket used for firework displays. That has a cardboard case filled with solid propellant powder. Much larger versions of that type of rocket motor can be made, except that the cases have to be much stronger and heavier, and the propellant itself has to be of a special kind, with strength to prevent it from deforming. But for really large rockets it is much better to use liquid fuels, because the rocket body can then be made lighter and more fuel can be carried.

The German Rockets

The V.2 which the Germans fired at us during the last war was a rocket of that kind, and so is an even larger single-stage rocket, the American Viking Rocket.

As the pictures show, both of these rockets are large, but, large as they are, neither of them is capable of going high enough and fast enough to put a satellite in flight round the world, and to explain why that is I would like to compare the task with mountain climbing. To put a satellite weighing as much as a man into an orbit round the earth needs exactly the same amount of work as would be necessary to put it on top of a mountain 2000 miles high.

To climb a mountain even five miles high, such as Everest, it is necessary to start with a lot of men at the bottom to get one man to the top. One man could not do it alone, because he could not start from the bottom carrying enough food and oxygen to get him to the top. A lot of men start by accumulating food and stores at the bottom, then many of them move a large part of the stores up to a higher camp, then some of them move some of these stores to a higher camp still, and a few of those move a part of the stores higher still, and so on, until the highest camp of all is reached. Only a very small proportion of the total food and oxygen which was assembled at the bottom is carried to the highest camp, and is then used by one or two men for the last stretch to the top.

In just the same way no single-stage rocket, with any fuels available at present, can start out with enough fuel and oxygen to get up to the top of a 2000-mile-high mountain, the equivalent of putting it into an orbit.

"Ah," you may say, "but the orbit does not have to be 2000 miles up." That is quite true; but the total effort necessary to put it even a few hundred miles up, and give it enough speed for it to go on round the world without falling down, is equivalent to putting it up 2000 miles against gravity as strong as we feel it on the face of the earth.

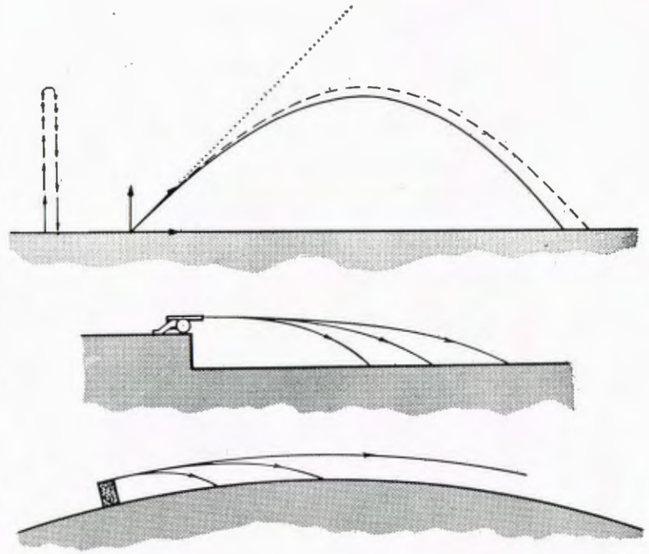


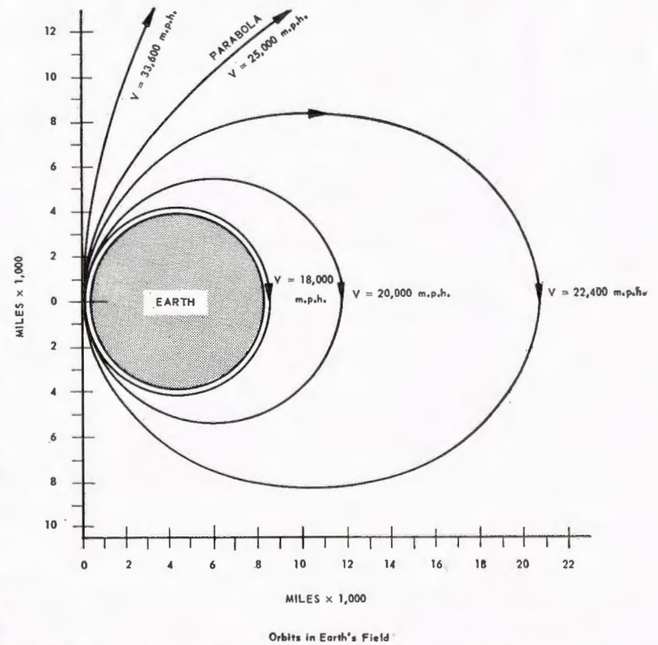
Diagram showing *the different angles of flight of* (a) *a stone thrown forward in the air;* (b) *a shot from a gun, the angle of descent varying with the speed of the projectile; and* (c) *a rocket, where, if the speed is fast enough, descent will be no steeper than the fall away of the curve in the earth's surface*

Stage by Stage

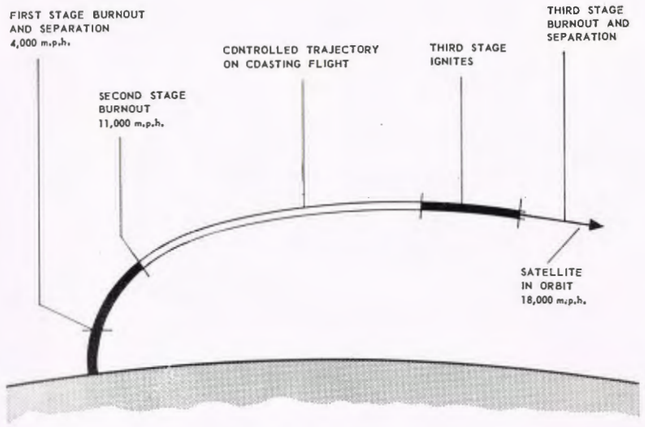
Just as men climbing leave some of the party behind at stages, so that less food and oxygen are necessary for the few who go on, so rockets leave behind parts as their fuel is exhausted. This is done by making the rockets in stages, a big one carrying a smaller one, and the small one carrying another even smaller.

When the fuel in the first stage is exhausted, the second stage separates, lights up and goes on.

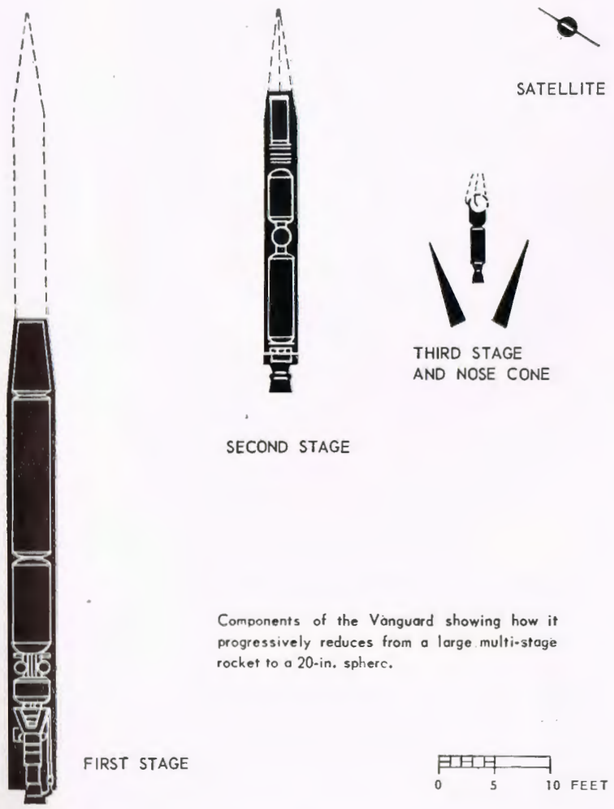
My last drawing shows how such a multi-stage rocket might be used to put up a satellite. The first stage carries the rocket up to about 50 miles, by which time it has a velocity of about 4000 miles/hour. The next stage boosts it up to about 150 miles and a velocity of 11,000 miles/hour. From there it freewheels in a controlled



Orbit shapes *of earth satellites at different speeds: the greater the speed, the steeper the parabola*



Launching trajectory *of a satellite reaching* 18,000 *m.p.h.*



The three stages *of an American Vanguard rocket*

flight to get it to the right height and direction. Then the third stage boosts up the speed to 18,000 miles/hour and goes on round the world, or it may just push out a separate little satellite, as Sputnik I did; but in that case the final stage of the rocket will follow the satellite round.

So we have a satellite in orbit.

I could go on to explain what conditions might be like in a satellite. I could remind you of the complete absence of noise. No rush of wind at 18,000 miles an hour. Even a sheet of newspaper pushed out of the satellite would go on moving beside it at the same high speed, and would continue on round the world many times. You would have no knowledge of up or down, no gravity. Water would not run out of a glass or down your throat, and if you felt lonely and sorry for yourself up there, tears you shed would not run out of your eyes.

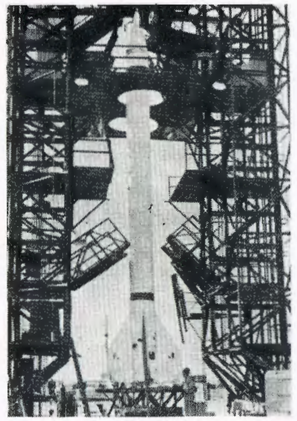
However, instead of telling you what it would be like up above in a satellite I would like to talk to you for a little while about the effect that this remarkable Russian achievement is likely to have upon us where we live, here on the surface of the earth and in this country.

A New Weapon?

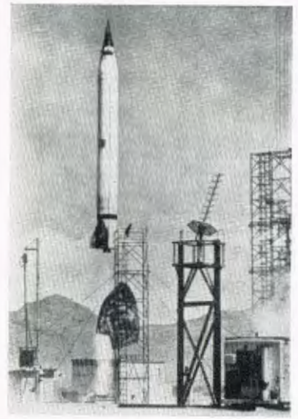
The thing that everybody tends to wonder, because we are at loggerheads with the Russians, is whether the space rocket is a frightful new weapon which adds to the dangers of war. At present it is not a weapon at all, except as a means of frightening people. The task of getting a satellite into the sky is a very difficult one, but the difficulty of getting a missile up into space and then bringing it back to earth with any accuracy is very much greater indeed. The danger from hydrogen bombs is great and frightening enough, but there is no need to suppose that they will threaten us from space for some years. Nevertheless, the Russians are ahead in this race, however foolish the race may be.

Next, a more pleasant excitement is to wonder whether men will soon fly to the moon and back. That is likely to be some long way off too, because, however it is done, the total effort involved is likely to be fantastically large.

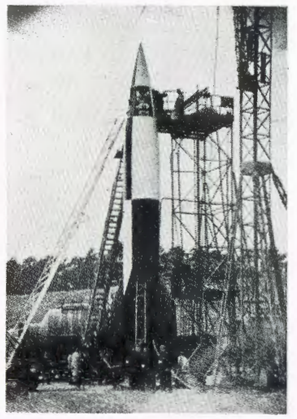
It may not be long before a small object is fired at or around the moon, but for a man to land on the moon and return to earth is a very different matter. The final-stage rocket carrying



An American Viking *rocket being prepared for launching*



The moment of launching: *an American Viking takes the air*



A German V.2 rocket *at ready*

a man would have to weigh at least 500 lb., and it would have to be carried off the earth by rocket, be slowed by rocket above the moon's surface, be fired again off the moon, and might then have to be slowed down by rocket before entering the earth's atmosphere. To do this the starting weight of the rocket would have to be greater than the weight of the *Queen Elizabeth* over 100,000 tons.

A better way might be to build a large satellite in space and use that as the advance camp for a climb to the moon and as an intermediate stopping point on the return journey. That would still mean an enormous expenditure of human effort.

To build a 100-ton satellite in the sky as a fuel station and starting point for space travel would mean firing off at least 1000 100-ton rockets to get materials up, quite apart from the ferry service necessary to get men up and down during construction or to keep them supplied. Taking that into account, it would probably mean firing 2000 100-ton rockets, say £1,000,000,000 worth of rockets, or about one million man-years of work. I don't think it will happen yet, not because it could not be done, but because it may not seem worth doing when the cost is considered. It may happen in the next fifty years, but only after new advances in science and technology make it possible to do it more easily.

"Well," you may say, "if the satellite isn't important yet as a weapon, and it isn't going to allow the Russians to claim the moon quite soon, does it matter very much at all?" My answer would be "Yes; it is very important indeed."

The Russian Lead

The Russian success in launching satellites shows how tremendously their technical strength has increased in recent years. It is not like the beginning of the motor car or of the aeroplane—a rather stumbling beginning by a few enthusiastic amateurs—but the result of a tremendous planned technical effort which has achieved its results with certainty and to time. It shows that there are not just a few good scientists in Russia, but that they have a lot of good scientists, a lot of good engineers, and a lot of skilled workpeople who are capable of doing all the complex jobs of modern industry.

We may decide, as a nation, that we don't want to compete with Russia or America in the production of satellites, or intercontinental missiles, or in getting to the moon first; but the skills which have enabled Russia to get in front in the satellite race will, very soon, make her a serious competitor of ours in industrial products throughout the world, and that is a form of competition which we cannot afford to ignore. Their success with the satellite points to that result more certainly than it does to flights to the moon.

More Technologists Required

The lesson to be learned from the satellite is a very sharp one. We have been saying for some years now that Russia is training a lot more scientists and technologists than we are in this country. We have been saying that if we do not do something about it they will overtake us. Now, in one respect at least, they have overtaken us, and the Americans too.

Some of you may be thinking that it is not your responsibility, that the Government ought to do more about it, or that somebody else ought to do something. But the training of technologists in sufficient numbers to keep us in a strong competitive position is only one way of safeguarding the future. Like most of the others, it can only be achieved, in a democratic country, if most people recognise its importance and if they are prepared to exercise some restraint in the present for the sake of the future. The necessity for us to do so is very strong indeed.

A Bygone Age

By the Editor

Liverpool, Glasgow and Swansea—what were they like on the eve of the Industrial Revolution? By 1728, the date of the print above, Liverpool was just entering on its career as the chief port for trade across the Atlantic; Glasgow was growing from being just a university town to a new prosperity founded on tobacco; and Swansea had just smelted its first copper.

Liverpool, according to Daniel Defoe, the author of *Robinson Crusoe*, writing in 1724, "is become so great, so populous and so rich that it may be called the Bristol of this part of England."

By 1728, when Samuel and Nathaniel Buck published the engraving reproduced above, Liverpool had just emerged triumphant from its rivalry with the ports of Chester and Bristol and had nearly 100 ships of over 50 tons. This surge of maritime activity had been accelerated by the completion at Liverpool of the first dock in England outside London. The dock can be seen just to the right of the church tower in the right-hand half of the picture. Before that, ships had to ride in the open roads behind a bar at the mouth of the Mersey. Thirty years later the number of ships had more than doubled and the port of Liverpool had won supremacy in the Atlantic trade from Bristol—a position it still holds.

The first slave trader from Liverpool sailed as early as 1709, but it was not until a few years after the date of our engraving that the regular slave trade got under way. On this trade the prosperity of Liverpool was founded; cheap cottons, spirits and firearms were bartered for slaves in West Africa.

Sugar refining was one of the results of the West Indian trade, and in the Bucks' engraving

65

Facies Civitatis GLASGOW *ab Oriente Estevo. The Prospect of ỹ Town of* GLASGOW *from ỹ North East.*

we have one of the earliest illustrations of a sugar house (16).

The fame of **Glasgow** dates from the days of the "tobacco lords," who rose to power with the development of the West Indies trade in the middle of the eighteenth century.

In 1693, when John Slezer published his *Theatrum Scotiae*, from which the engraving on the previous page is taken, Glasgow, if it was known at all outside Scotland, was regarded as a cathedral and university town—its university is the fourth oldest in Britain, beaten only by Oxford, Cambridge and St. Andrews, and was founded by Papal Bull in 1450.

Slezer's engraving shows the cathedral, the Bishop's Castle (removed in the 1780s), and in the distance to the left of the picture the Old College (the University moved to its present site at Gilmorehill in the 1860s, and the site of the Old College is now occupied by College Goods Station). In the middle distance are the houses and gardens of the pre-Reformation canons of the cathedral.

The Union of the Scottish and English parliaments in 1707 brought to an end the great days of Edinburgh, but for Glasgow the good times were just beginning. 1707 saw the first tobacco boat sail to America. Seventy years later, at the time of the American War of Independence, the city had nearly 400 ships engaged in the tobacco trade.

The burn in the foreground of the picture is the Molendinar, a tributary of the Clyde, which in Slezer's day was still a shallow salmon stream. The Clyde as we know it today is a man-made river.

The St. Rollox district where Charles Tennant established his bleach works in 1797 (St. Rollox Works today is part of Nobel Division) is the expanse of bare moorland visible in the background of our picture.

The **Swansea** engraving above is also the work of the Buck brothers. It is dated 1748. The Industrial Revolution, however, came late to Wales. While the population of Glasgow and Liverpool had by this time both risen to over 20,000, Swansea, even though the largest port in South Wales with a coal trade round the coast and as far afield as France and Portugal, had a mere 3000 inhabitants. In those days a miner earned about a shilling a day and coal was increasingly displacing charcoal as the fuel for smelting ores.

Today Swansea is the chief centre of the tinplate industry, and it was on this and on the copper trade that the prosperity of the town was founded back in the eighteenth century. The first copper smelting works there was set up in 1720.

NEWS IN PICTURES

Chairman's honorary degree. *Sir Alexander Fleck was greeted by Queen Elizabeth the Queen Mother when he arrived at the Senate House of London University on 22nd November to receive the honorary degree of Doctor of Science. Her Majesty, Chancellor of the University, conferred degrees on six eminent people*

Central Council—1. *The forty-fourth meeting of Central Council was held once again in the exotic setting of the Winter Gardens at Blackpool. It was attended by about 600 delegates and observers. Mr. S. P. Chambers was in the chair deputising for Sir Alexander Fleck, who was at London University*

Central Council—2. *Mr. L. B. Ryder (Division chairman) received the I.C.I. Safety Cup on behalf of Lime Division, who had achieved a 28% reduction in their accident rate over their previous best record. Billingham Division were runners-up*

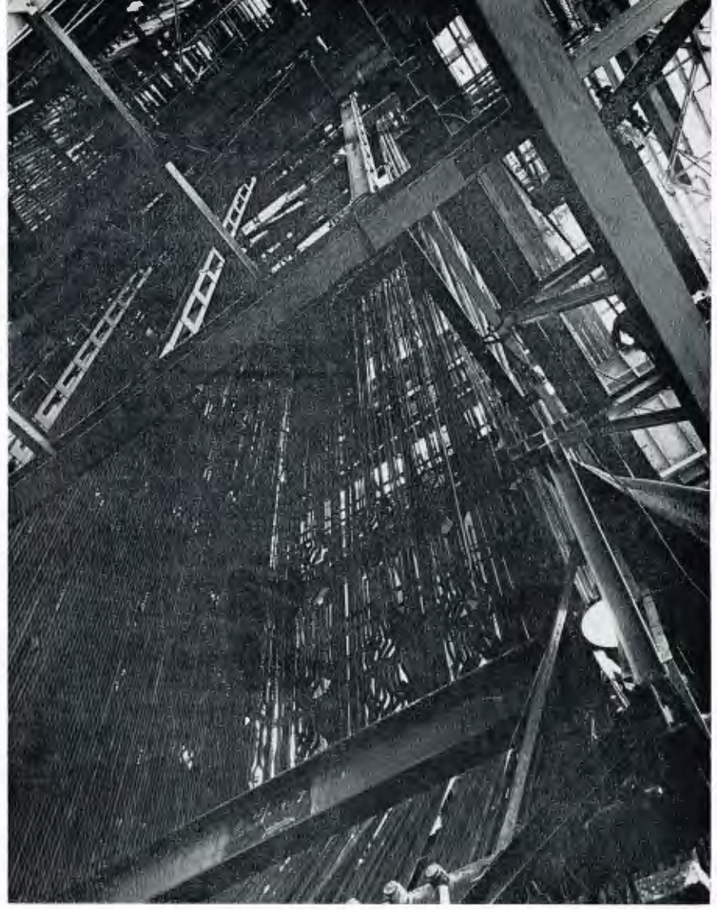
Central Council— *was elected as chairm running. He is seen I.C.I.*

3. Mr. E. Hutton of Cassel Works, Billingham (left), an of the workers' representatives for the second year above lunching in the Winter Gardens, Blackpool, with Deputy Chairman, Mr. S. P. Chambers

Central Council—4. *TV star Carole Carr was obviously top of the bill for Central Councillors when she sang at the pre-Council dinner held at Blackpool's Norbreck Hydro. Also taking part were comedian Jon Pertwee and the Maori singer Inia te Wiata*

Plaque unveiled. *A plaque commemorating the work of Mr. John Rogers (left) in establishing a permanent headquarters in London for the Society of Chemical Industry was unveiled by this year's president, Mr. H. Greville Smith (C.I.L. president), during his recent visit to Britain*

The 'Terylene' adventure. *In the third of his TV series "Adventure in Industry" Mr. Aidan Crawley traced the history of the 'Terylene' project, showing viewers film taken at Fibres Division headquarters, Wilton and Millbank. In this picture he is seen talking to Mr. J. R. Whinfield (left), the inventor of 'Terylene,' at Harrogate*



Biggest boiler. *Wilton's No. 5 boiler, the largest on any industrial site in Britain, came on stream in November. It has double the capacity of each of the three existing boilers and a weekly fuel consumption (powdered coal) of nearly 5000 tons. Our picture, taken during construction, shows the main furnace built up entirely of tubes*

Billingham's newspaper. *"The Billingham Post," the first works newspaper started up within I.C.I., recently celebrated its fifth birthday. Circulation now exceeds 10,000. The newspaper is printed at the South Shields Newspaper Office, where our picture of the high-speed rotary machines in action was taken*

First million. *Celebration cake at Ardeer Propulsive Department's social was decorated with a chocolate rocket. The social was held to celebrate the department's safety achievement of 1 million man-hours without an accident. Above: Mrs. Jean McMillan and Mrs. A. E. Harper cut the cake, watched by Messrs. McCulloch, Hamilton, Cambridge, Harper and Lambie*

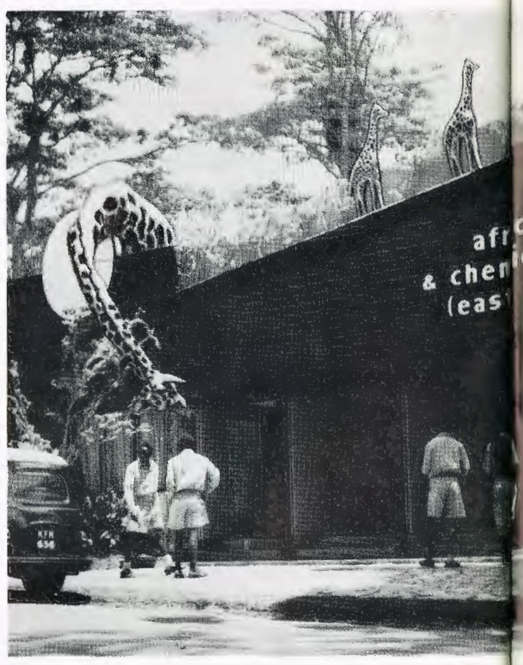
Westfalite rock 'n' rollers. *Detonator coiler Sandra Lindsay and Margaret Brammer, who works in Electric Fuse Department, put in some practice in the lunch break. Miss Lindsay, Skegness Holiday Camp rock 'n' roll queen, has been invited to appear in the London finals—first prize a week in Paris*

50 years. *Mr. Roderick Reynolds (right) of Cassel Works HCl Plant at Billingham was presented with a gift from the Company by Dr. R. N. Kerr (left) when he retired after 50 years' service*

PICTURES FROM OVERSEAS

New Zealand. *"Aerial agriculture" has completely changed the pattern of agriculture in New Zealand, where steep pastures are being fertilized and re-sown by aircraft. Helicopters are being used to spray crops with hormone weedkillers, and I.C.I.(N.Z.) has played a significant part in this particular development*

Australia. *At the winding-up night of the Melbourne basketball league the I.C.I.A.N.Z. girls celebrated their victory with a "Charleston" act. A repeat performance was staged for the cameraman on the roof of the Melbourne office*



Kenya. *A.E. & C.I.'s Agricultural Department have adopted a giraffe as their new trade insignia. Above: The Company stand at the Royal Agricultural Show of Kenya, with the giraffe very much in evidence peering through the entrance from "upstairs." Both A.E. & C.I. and I.C.I. products were featured on the stand*

Rhodesia. *Three thousand tons of reinforced concrete are blasted into fragments as the coffer dam at Kariba is breached. Work has already begun on the second stage of building the barrier wall which will hold back the Zambesi and bring into being the world's largest man-made lake. The demolition was planned by A.E. & C.I. engineers*

Australia. *Twenty-one-year-old Sydney University student Miss Ruth Kirkland was the guest of I.C.I.A.N.Z. Directors at lunch at I.C. House, Sydney. The lunch marked her achievement in winning first prize in the* Endeavour *essay competition. Our picture shows Miss Kirkland (left) with Mr. L. W. Weickhardt (Technical Director) and Miss Helen Barder (Sydney Librarian)*

People and events . . .

Sir Ernest Oppenheimer, who died in November at the age of 77, had been Chairman of African Explosives and Chemical Industries Ltd., I.C.I.'s associated company in South Africa, since 1931.

A.E. & C.I., now the largest private enterprise industrial corporation in the Union, was formed in 1923 by the amalgamation of the Nobel Group's explosives interests at Modderfontein and Umbogintwini and the De Beer's explosives interests at Somerset West. Sir Ernest was one of the original directors.

He had gone out to Kimberley at the age of 22 as agent for a diamond company. By the time he was 37 he had founded the Anglo-American Corporation of South Africa together with an American consulting engineer. In 1929 he became chairman of De Beers.

Throughout the years he continued to take a close and detailed interest in the activities of A.E. & C.I., despite the large network of gold, diamond, copper and coal mining companies he controlled.

* * *

Sir Alexander Fleck writes:

"Sir Ernest's remarkable career and the great part he played in the industrial development of the Union of South Africa and of Rhodesia are too well known to require elaboration from me. Rather would I write of him as a man.

"Sir Ernest as I knew him was very different from the conventionally accepted figure of an industrial magnate with a large personal fortune in his own companies. Slightly built, somewhat shy and self-effacing, he never sought the limelight or the headlines or sought to cut a great figure in the social world. On the other hand, you had only to sit in conference with him to appreciate the rapidity with which his mind worked in getting to the root of a financial or commercial problem, and to realise how determined he was to see not only a continued expansion of industry in the Union and Rhodesia but also a higher standard of living for all classes and races to keep pace with that expansion.

* * *

"In his private life he lived simply, but his home in Johannesburg contained much of what any collector would be proud to own. He was never happier than when entertaining his friends and colleagues there, and I and my colleagues who have been associated with him in the direction of A.E. & C.I. will long remember the parties at "Brenthurst" and Sir Ernest's ease and charm as a host.

"Finally, I would like to pay a tribute to his great contributions towards the Commonwealth. A personal friend and supporter of Field Marshal Smuts, he actively fostered all his life the idea of an expanding Commonwealth, united in loyalty to the Crown, and one of his most recent actions in pursuance of that ideal was to donate £100,000 towards the founding of an Institute at Oxford for the study of Commonwealth problems."

Mud, Glorious Mud

A SUGGESTION SCHEME award—probably quite a substantial one—awaits the man who can solve Wilton's mud problem.

Nine per cent of all road accidents at Wilton in recent years have been caused by vehicles—particularly cycles and motor-cycles—skidding on mud or ice. The mud is carried on to the roads by vehicles from the construction sites.

In a recent period of six months about 34,000 lorry loads of excavated material were taken from the construction areas to the tipping areas, every lorry transferring some of the mud from its tyres to the road surface.

Mr. W. Evans, Wilton Site Maintenance Section Manager, says that in addition to normal road-cleaning expenditure something like £500 a month is being spent on cleaning mud from main roads near the construction areas.

Mechanical sweepers tend to get their brushes clogged with mud and are not very effective on roads which have not had their final surfacing. Hand brushing is slow, and heavy on manpower. Hand and tractor-driven rubber squeegees are used when the mud is very wet and thick but are not much use when it is stiff and compact. A road-washing vehicle, using a powerful jet of water, is effective, but it washes mud into the road drainage system and uses a great deal of water; in many areas the water supplies and drainage services are not yet operating.

All the obvious preventive measures have been tried, such as cleaning the lorry wheels by hand as they enter the road (too slow—it may take thirty minutes); washing the wheels with a high-pressure hose (water supply and drainage problems again); driving over a grid (it removes some mud but only loosens the remainder, which then falls on to the road); and driving over a bed of clinker (the clinker gets choked and needs frequent renewal).

Any solution to the problem will have to take into account the very wide variety of vehicles used.

Chairman's Degree

Sir Alexander Fleck was one of six eminent people who received honorary degrees of London University in November. It was this ceremony that prevented him from being present at the Central Council meeting.

The degree of Doctor of Science was conferred on Sir Alexander by Queen Elizabeth the Queen Mother, who is chancellor of the university. In his oration the public orator referred to Sir Alexander's early academic career. "Had he chosen to remain in the academic world," said the orator, "he could hardly have failed to achieve the highest distinction as a pure scientist.

"As an administrator he has shown immense drive and initiative; yet as chairman of Imperial Chemical Industries he has not thought of himself as an emperor, but rather as the leader of a vast army of fellow workers. Not the least remarkable feature of I.C.I. has been its enviable record of good industrial relations; and this tradition, handed down to his successors by Lord Melchett, has been vigorously sustained, and even extended, in profit-sharing schemes and other measures, by its present chairman."

* * *

At the end of the ceremony Sir Alexander made a speech of thanks on behalf of the honorary graduates. In it he referred to a previous occasion when he had been "up for a 'viva' before Her Majesty." This was during a wartime visit of Queen Elizabeth and King George VI to Billingham. "It fell to me," said Sir Alexander, "to demonstrate some of the wartime workings of industry and in particular to tell Her Majesty something of the strange ways of settling internal works problems. And so I was in a thorough —but, I hasten to add, most kind—way questioned on some of the intricacies of collective bargaining."

Nightmare

PEOPLE often dream longingly of perpetual summer, but only in a nightmare do they contemplate perpetual winter.

For **Mr. Mick Headberry,** contracts engineer of I.C.I.A.N.Z., the nightmare is coming true: he has just begun his fourth winter in a row.

After enduring Melbourne's winter of 1956 Mr. Headberry was sent to

England on a job, arriving in November. The following June he returned to Australia in time for *their* winter, and recently he received word to pack his grips and come back to England again.

Tides at Winsford

SALT Division's mine at Winsford, the only salt mine in Britain, is making a useful if somewhat passive contribution to the International Geophysical Year.

Scientists at Cambridge University's Department of Geodesy and Geophysics are interested in a phenomenon known as "earth tides." The solid parts of the earth are not entirely rigid, and are distorted by the pull of the sun and the moon in the same way as the oceans—although to a much smaller degree.

It is in measuring these distortions of the earth that the salt mine comes in useful. At the bottom of the mine, which is 490 ft. below ground level and therefore suitably isolated from surface disturbances, are installed two so-called horizontal pendulums, one swinging N.-S., the other E.-W. These can best be described as miniature five-barred gates supported by thin filaments. On each is a small mirror which reflects a trace of light on to a strip of photographic film. The film is moved steadily forward by a clock mechanism and any tilt of the earth is shown on the photographic record.

* * *

The apparatus also measures distortion of the earth brought about by the movement of low-pressure systems in the atmosphere. Wherever these are present part of the burden on the earth is relieved and whole continents are liable to tilt.

In case anyone should visualise being thrown off his balance by an earth tide it might be as well to add that the effect at any one point on the earth's surface is roughly equivalent to the movement that would be felt in Winsford if Cairo were moved up and down one foot.

The Things They Say!

OUR invitation to readers to send in stories about I.C.I. has resulted in a rich haul of Imperial Comical anecdotes.

I.C.I., it seems, is a fruitful object of misapprehensions, particularly in France, where notices like "Ici Shell," "Ici Mobiloil," Ici Danger" and even "Ici Crustaces" never fail to swell the chests of those who don't know the lingo. **Mr. Alfred Smith,** who works in the Engineering Workshops at Billingham, very sportingly tells one of these stories against himself. Fortunately his son, who had just graduated in modern languages, was able to put him right when he commented on the size of I.C.I.'s interests in Paris.

The two best Continental stories came from **Miss Kathleen Wilkie** of Treasurer's Department at Head Office and **Mr. Kenneth Lunn** of Dyestuffs Division Publicity Department, both of whom win £2 2s.

* * *

Miss Wilkie was on holiday in Belgium during the early days of I.C.I. Being a member of H.O. swimming club, her bathing suit was adorned with the red and white I.C.I. badge. In those days the *concierge* of each particular strip of beach took complete charge of one's swimming regalia and

produced it every morning, dried and neatly folded.

Miss Wilkie arrived one day to find the lady in a state of consternation. Mamselle's things could not be found! Alas, what was she to do? The only remaining suit—*voilà!*—clearly belonged to a French lady, having the word "Ici" marked on it for all to see!

* * *

Mr. Lunn's story does not come strictly within the terms of the competition, but is too good to miss.

It concerns **Mr. W. R. Tepper**, now with Dyestuffs Division's Publicity Department, who was engaged on technical service work in France.

One day he was with **M. Henri Tardy**, the local agent, in the latter's car.

In driving away from a hotel M. Tardy very slightly grazed the wing of the car parked in front. The next moment they were assailed by a torrent of outraged indignation from the car's owner—a small but fiery Gallic old gentleman of imperious aspect.

"Messieurs, you shall hear from my solicitors!" spluttered the offended one. "Voici ma carte—le comte de D——!"

"Ah, merci," replied M. Tardy, bowing and producing his own card. "Moi, je suis Henri Tardy. And my colleague here, le vicomte de Lissapol!"

Formal exchange of bows between the two "titled" ones.

"Good day, messieurs!"

"Good day!"

Understandably, this incident was recounted back at the office, and even to certain customers, with the result that during his remaining years in France Mr. Tepper was widely known as "le vicomte de Lissapol."

* * *

The best story of all is a very short one, and it wins £3 3s. for **Mr. D. W. Glen** of the Northern Region Sales Office.

In the days of I.C.I. (Fertilizer and Synthetic Products) Ltd., Billingham, a member of the staff approached a dear old lady who provided board and accommodation for gentlemen. She opened the door, looked very shrewdly

at the applicant, and murmured: "I only take clergymen and synthetic gentlemen."

Oldest Pensioner

THE Kynoch Press, which is part of the Kynoch Works of Metals Division and which prints the *Magazine*, has lost one of its oldest pensioners.

He was **Mr. Samuel Nutt,** who died recently within a month of his 93rd birthday. He retired in 1933, having spent the whole of his working life as a compositor. At the annual pensioners' dinner he was a well-known and well-loved figure. His dignified bearing and immaculate appearance made him a favourite with press photographers, and he dearly loved being photographed with his daughter, who is also a Metals Division pensioner.

Care of Paintings

LAST month's article entitled "The Care of Paintings" has been much praised, and several people have asked the name of the author.

The article was actually the joint work of two scientists of the National Gallery staff, **Norman Brommelle** and **Garry Thomson.**

The restoring of pictures, as the article showed, is now a highly technical business, and Mr. Brommelle, the Gallery's restorer, is not a dear old craftsman with a long white beard but a young research physicist. He is the man who bears the frightening responsibility of actually laying hands on centuries-old pictures. It is not surprising to learn that he may take two months to examine a picture before touching it and a further two years for the actual restoration work.

Mr. Thomson is the Gallery's research chemist. He is no stranger to I.C.I., having worked for four years on the editorial staff of *A History of Technology* after leaving Cambridge. His interest in art is more than scientific, and his particular interest in oriental art stems, perhaps, from his marriage to a Siamese girl.

Aerial Agriculture

IN New Zealand nearly 4 million acres of land were top-dressed last year with ½ million tons of fertilizer dropped from aircraft.

These impressive figures give some idea of the way aerial agriculture has developed in New Zealand. Two-thirds of the country's land area was once classified as too steep to cultivate, but the advent of aerial top-dressing has completely altered the picture.

The steep pastures are not only being fertilized from the air, but also sprayed with weedkiller and re-sown with improved grasses and clovers. In the 15 million acres of hill country that need to be fenced against rabbits, aircraft can fly in the posts and wire and drop poisoned baits.

NEWS IN BRIEF

Skilled Status. The first apprentice to be trained entirely at the Kirkby Works of Metals Division, Henry McLoughlin, has attained skilled status.

Rose-grower. Mr. A. E. Shipp, a fitter at Paints Division's Stowmarket Works, has been elected vice-president of the National Rose Society.

Millionaires. The explosives department at A.E. & C.I.'s Somerset West factory has completed a million man-hours without a lost time accident.

Christmas Tree. The Synthonia Club at Billingham was presented with a Christmas tree by a Swedish shipping company.

New Magazine. I.C.I.(N.Z.) is to build a new explosives magazine, with a capacity of 600 tons, at Waitawa Bay, 37 miles from Auckland.

'Visqueen' Reservoir. A 600 ft. long, 80 ft. wide reservoir scooped out of the ground and lined with 'Visqueen' film is being used in Australia for evaporation experiments.

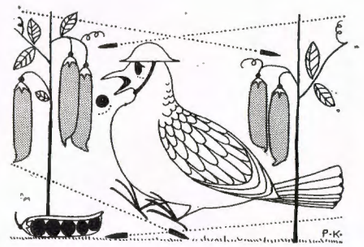
Spring Launching. Nobel Division's new diesel-powered coasting vessel, now being built in Ardrossan dockyard, will be launched in the spring.

Altogether there are 300 aircraft, operating from some 8000 makeshift airfields, engaged on such jobs. I.C.I.(N.Z.) has played a significant part in the introduction of the helicopter for spraying hormone weedkillers and was largely responsible for calibrating the spray equipment. Only a helicopter can fly with the accuracy necessary for this job, and the downwash from the rotor blades, which agitates the foliage of the plants, means that the spray coverage is increased.

Pigeons Again

THE Ministry of Agriculture, the I.C.I. Game Research Station and other organisations concerned with the control of farm pests have launched a new campaign against woodpigeons.

The National Pigeon Week that took



place last summer stimulated such interest in pigeon shooting that another is being organised for the end of this month. During this Pigeon Week experts will give practical demonstrations of hide-building, the use of decoys, personal camouflage, and all the things that contribute to bringing the birds to the gun and making a successful day.

There is no close season for woodpigeons, but the farmers are most anxious to have them shot when the spring peas and beans are coming on and the young crops are most vulnerable.

The woodpigeon is cunning, flies well, and has eyes like a hawk; shooting him is a real test of skill. Whether the plan is to shoot over decoys or take part in a winter "battue" shoot of birds coming in to roost, his habits must first be studied and every resource of fieldcraft brought into play.

NEW APPOINTMENTS

Some recent appointments in I.C.I. are:

Heavy Organic Chemicals Division
Mr. F. T. Gow. Chief Accountant.

I.C.I. (Malaya)
Mr. H. T. Benny. A director.
Mr. H. G. Owen. A director.

TWENTY-FIVE YEARS OF 'PERSPEX' (*continued from page 5*)

reached a wartime peak in 1944, when according to official statistics exactly 4701 tons were produced.

The post-war slump in aircraft production cut back 'Perspex' sales in one swoop. I.C.I. was faced with the prospect of shutting down one or more plants unless some immediate commercial market could be found; and the prospects for many of our customers—the small shaping and pressing firms—were no less bleak. A courageous decision was made to keep all the plants going, although obviously they could not operate to anything like capacity. At the same time an ambitious campaign to promote new uses was launched both at home and abroad

The success of this campaign was phenomenal. Within twelve months of the ending of the war 'Perspex' had switched over from 100% war effort to even greater production for entirely new commercial uses. All this was a grand feather in the cap of the development and technical service staff.

The first coloured 'Perspex' was made about this time. It was rapidly taken up by colour-starved Britain, and soon a "silly season"—the era of 'Perspex' brooches, cigarette cases, biscuit barrels, ashtrays and a thousand and one similar gaudy objects—was in full swing. Vulgar as they undoubtedly were, they helped avert the crisis. Today I.C.I. produces a wide range of transparent, translucent and opaque standard colours covering the whole of the spectrum, as well as a few special colours for important individual applications.

Colour in 1946 was, then, the second milestone in the story of 'Perspex': the third and latest (a tribute to the success of the post-war sales drive) was the opening of the Wilton plant in 1949. The wartime factories hurriedly set up were not ideal. The Wilton plant, by contrast, is a planner's paradise. Here all the heavy work involved in loading the ovens and in filling the cells has been eliminated through mechanisation, and one man now does the work that it took eight to do at Darwen or Rawtenstall.

Wilton and Billingham between them can turn out over 8000 tons of sheet a year. Thicknesses vary from one millimetre to four inches. Four-inch 'Perspex' block—a fairly recent introduction—is a very considerable technical achievement. The old shadow factory at Rawtenstall was closed in 1949, but Darwen is still in production and has a capacity for a further 3000 tons. The fabrication of corrugated 'Perspex' for roof lighting is centred here.

In the eight years the Wilton plant has been running, production has more than doubled. Over half our production now goes overseas. Our only considerable rivals in the methacrylate sheet market are the two Rohm and Haas companies in Germany and the U.S.A. The aircraft industry now accounts for only 10% of I.C.I.'s sales. Top of the list in recent years has been the lighting industry, with the aircraft, automobile, radio and television, and advertising sign industries following in that order.

'Perspex' these days is used for anything from a desk ruler to the giant Bovril and Coca-Cola signs in Piccadilly Circus; from safety goggles to the covers for oxygen incubators for premature babies; for baths and washbasins (coloured 'Perspex'), for umbrella handles and door handles, for medical instruments, chemical plant, fountain pen barrels; and so the list goes on.

Ten years ago 'Perspex' was in the doldrums. Production the previous year had reached just over 2000 tons and future prospects did not seem very rosy. Pessimists voiced the view that 'Perspex' had passed its peak, and even the most sanguine scarcely thought of production in terms of five figures. Yet last year production ran out at over 11,000 tons, or five and a half times the 1945 level.

Thorp's Run

By John Watney

MAJOR Thorp, the headmaster of the first boarding school I went to, was a tall, military-looking gentleman dressed in the Norfolk jacket and thin breeches of the previous century, who believed that the development of an English boy's character was far more important than his knowledge of Latin, Greek, science or mathematics.

For this reason he used to organise tests where we were put into the sort of situations in which, according to Major Thorp, we might find ourselves when we grew up. As Major Thorp's general view of the world was that once you crossed the Channel you were entirely surrounded by savages whose sole ambition was to do the Englishman down, these tests had a rather romantic flavour about them.

"How to be calm in an earthquake" was, I remember, one of them; and for this four boys held a tarpaulin rigid, across which the victim walked. At a given signal the boys shook the tarpaulin violently while the Major dropped copper kettles on the floor and fired blanks in the air. The object was not only to get across the tarpaulin, but to say, in a perfectly normal way, when you got to the other end: "Could you direct me to the Residency, please?"

Another was "How to deal with the Unfriendly Alien." The Unfriendly Alien in this case might be anything from a Paris apache intent on stealing your cigarette cards to a dervish who might creep up on you with a blank pistol and a curved scimitar which Major Thorp had brought home from some foray in his youth. In each case, of course, the Alien was Major Thorp himself, suitably disguised: a coloured handkerchief round his neck for the apache, a long dressing-gown and turban for the dervish. Points were scored not only for the speed with which you recognised his disguise but with the calmness you showed in these sudden and, at times, quite frightening apparitions.

But the final test, without which you could not get your Badge of Worthiness, was known as Thorp's Run.

It always took place on a Sunday afternoon and it consisted in going out on to the playing field and joining Major Thorp, who always on these occasions wore a sort of Sherlock Holmes hat stuck with coloured flies. When the six or eight of you who were to be tested were there, Major Thorp would pull out an army compass from his pocket and say, in a thoughtful and commanding tone of voice: "We'll march on a bearing of ninety degrees north."

At this, the candidates for the Badge of Worthiness, who were divided into pairs, each made the necessary adjustments to their own compasses and set off, regardless of trees, ditches, fences or roads, in a dead straight line at five-minute intervals. The point was to keep going until, as Major Thorp put it, "you came up to a blank wall."

The first time I entered for this test I drew as partner a boy called Widgeon. He was one of those very small boys whose faces are almost completely hidden by glasses and wire teeth-straighteners, who plod on steadily and unspectacularly at school, and turn up years later, still with their mouths full of plates, as heads of departments.

He was not a particular friend of mine at the time, but when competing in anything as stiff as the Badge of Worthiness what you needed was a good steady plodder, a fellow who even if he were as blind as a

"We'll march on a bearing of ninety degrees north"

"We'll march on a bearing of ninety degrees north"

bat could be relied upon to hold a compass steady all day long and not be put off by any obstacles.

We set off together, then, Widgeon in front and I following; while Major Thorp sped on ahead in order to create, as he put it, "a few surprises on the way." The course lay across the end of the football field, straight through a huge clump of rhododendron bushes, over a bank, through a hedge and thus on to the main road, across this and then along the side of a sort of valley, known to the school as the Dumping Ground, where the scouts had their annual camp.

Widgeon, with the compass close to his face, trotted gamefully on, barging occasionally into a tree or falling down a rabbit hole but maintaining on the whole a remarkably straight course all the same.

It was when we had got towards the end of the Dumping Ground and were once again climbing up to civilisation that I stopped him and said:

"Are you sure we're right?"

"Quite sure," he said; "ninety degrees north." He pointed to the compass. "You can see for yourself."

I peered over his shoulder. "Looks all right," I said.

"Why are you worried?" he asked.

"Well," I replied, "we haven't seen anything of either Major Thorp or of the others."

"They're probably ahead."

"Fortescue Minor," I said, "who took this test last week, said that Major Thorp and some of the seniors always dressed up as Arabs and attacked when the parties are crossing the Dumping Ground; and here we are climbing out the other side."

"I expect he wanted to have a change."

"Yes," I said doubtfully; "I suppose so. We had better go on in that case."

"Ninety degrees north," said Widgeon, applying himself once more to the compass.

Although the Dumping Ground was fairly familiar

Snake Charmer—Tangier

Photo by E. B. James (Plant Protection Ltd.)